



Software Reuse



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Acronyms

- AC Advisory Circular
- ACO Aircraft Certification Office
- API Application Programmer Interface
- CI Configuration index
- FAA Federal Aviation Administration
- LRU Line Replaceable Unit
- PR Problem Report
- PSAC Plan for Software Aspects of Certification
- RSC Reusable Software Component
- RSCD Reusable Software Component Developer
- RTOS Real-time operating system
- SAS Software Accomplishment Summary
- SCI Software Configuration Index
- SW Software



Two Documents

- **Notice 8110.97**
 - Reuse of software life cycle data
 - Formally known as 8110.reuse
 - Completed February 2002
 - Was “messed up” by editorial process
 - Chapter 12 of Mega SW Order (8110.SW)
- **8110.RSC (draft 10)**
 - Reuse of entire components
 - In and across company boundaries
 - Targeted completion - February 2003
 - May become an Advisory Circular



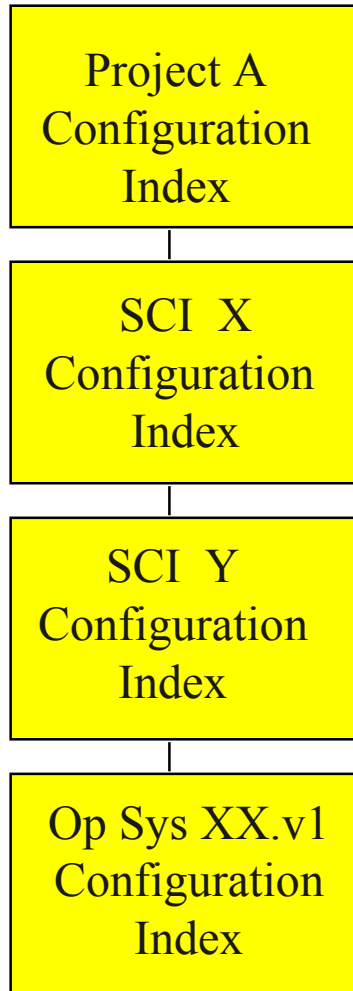
Chapter 12 of Mega SW Order (Notice 8110.97)

**Entitled: “Approving Reused
Software Life Cycle Data”**

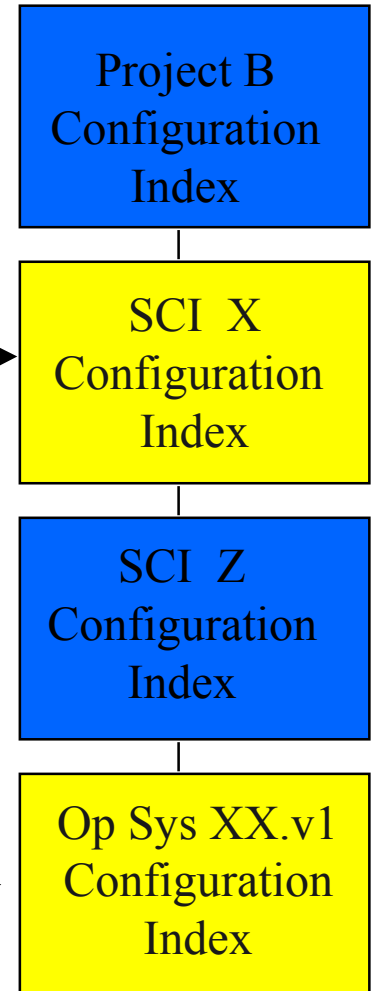


Conceptual Framework

Project A



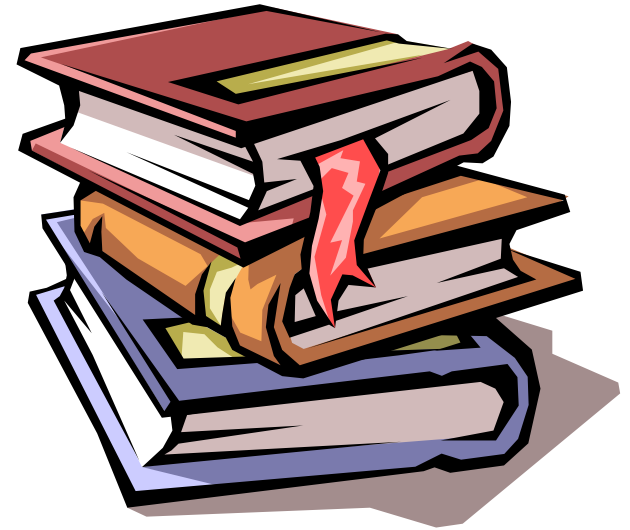
Project B



**Reuse data listed
in the SCI-X and
OpSys XX, CI**



5 Sections



- **12-1: General**
- **12-2: Software Suitable for Reuse**
- **12-3: Safety Considerations**
- **12-4: Factors Affecting Reuse**
- **12-5: Reuse Approval Guidelines**



Summary of Chapter 12 of Order 8110.SW (Notice 8110.97)

- Reuse of software life cycle data on multiple certification projects is feasible
- If a data item hasn't changed and is applicable for the current project, it is a candidate for re-use
- Present plan for reuse in PSAC and get early ACO agreement



8110.RSC

Entitled:

**“Guidelines for Accepting
Reusable Software Components”
(Draft 10)**

**Goal: To be able to carry certification “credit”
for reusable software component from one project
to the next**



11 Sections

- **1-3: Purpose, Distribution, Related Publications**
- **4: Definitions**
- **5: Acronyms**
- **6: Background**
- **7: Discussion**
- **8: Guidelines**
- **9: Common Reuse Issues and Considerations**
- **10: Changes to Components**
- **11: Conclusion**



Section 4 Highlights

~Definitions~

- Reusable software component (RSC) is the software code and its supporting DO-178B documentation being considered for reuse. It forms a portion of the software that will be implemented by the integrator/applicant.
- Reusable software component developer (RSCD) is the manufacturer of the reusable software component.



Section 4 Highlights (cont)

~Definitions~

- Integrator is the manufacturer responsible for integrating the re-useable software component into the target computer and with other software components.
- Applicant is the manufacturer seeking certification or authorization of the overall system.



Section 6

~Background~

- Traditionally, software approval is at the system level.
- There is currently no vehicle to carry certification credit across project boundaries.
- Purpose of this notice is to provide guidelines for allowing “credit” across projects.



Section 6 (cont)

~Background~

- RSC Examples:
 - Operating Systems
 - Libraries
 - Input/Output Data Files
 - Loading Software
- Guidelines are applicable within a company or across company boundaries.



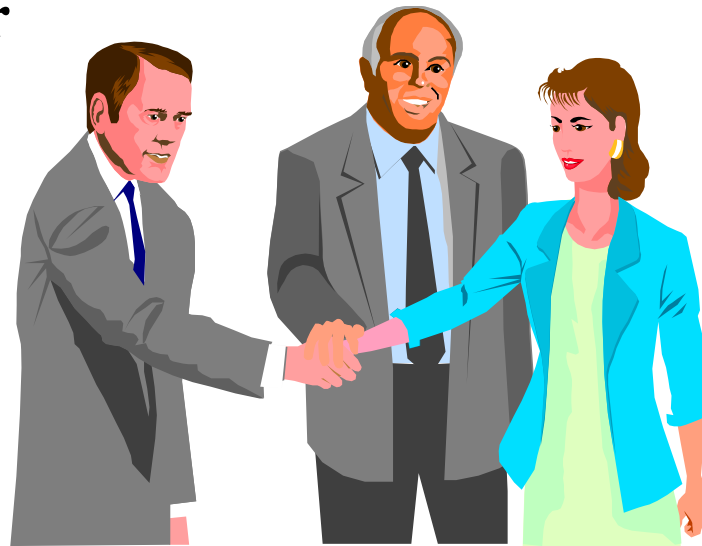
Section 7

~Discussion~

STAKEHOLDERS

Integrator

**Reusable Software
Component Developer
(RSCD)**



Applicant

**Certification
Authorities**

Note: Cert authorities may have more involvement than a traditional software development project for the initial component development14



Section 7 (cont)

~Discussion~

- Scoping the RSC guidelines:
 - 7a – First acceptance of RSC is a “real” project
 - 7b – Stakeholders agree on reuse
 - 7c – Each project is unique and might have different “credit”
 - 7d – Applicant is responsible for final cert

Overview of the Process



Stakeholders agree that reuse is a desirable & obtainable goal.

RSCD, integrator, & applicant plan for reuse.

RSCD, integrator, & applicant document reuse credit per objective.

PSAC reviewed & approved by cert authorities.

RSC developed per plans with cert authority oversight.

ACO writes acceptance letter for RSC to RSCD and applicant.

Same configuration & version of RSC used on other programs within limitations.



Section 8a – Guidelines for RSC Developer

- Document Reuse intent in the PSAC
 - Reuse credit for each objective
 - Assumptions for each objective
 - Means of compliance for each objective
 - Remaining activities for the installer/applicant for each objective



Example Approach (Appendix 1)

<i>178B Obj #</i>	<i>Obj Description</i>	<i>Credit Sought</i>	<i>Assumption</i>	<i>Means of Compliance for the Objective</i>	<i>Activities Remaining For Integrator/Applicant</i>
1-1	Software development and integral processes activities are defined.				
1-2	Transition criteria, inter-relationships and sequencing among processes are defined.				



Section 8a (cont) – Other Responsibilities of RSC Developer

- Document safety-related issues
- Coordinate & follow plans with all stakeholders
- Submit SAS and SCI at end of project, with the completed compliance tables
- Supply data to support the type certificate to the applicant



8b – Integrator/Applicant Responsibilities

- Integrate RSC data into the project data
- Specify the life cycle data needed from the applicant
- Consider safety issues of the RSC
- Coordinate & follow plans
- Consider open PRs of the RSC
- Validate assumptions made by the RSC developer
- Complete the RSC objectives tables in the SAS



8c – Cert Authority Guidelines on 1st Approval of the RSC

- Involve all stakeholders
- Involve technical experts, as needed
- Review plans of RSC developer and 1st applicant for consistency
- Perform reviews, as needed
- Approve project, when objectives are satisfied
- Write letter for RSC developer explaining acceptance, limitations, etc.



8d – Cert Authority Guidelines on Subsequent Use of RSCs

- Review the acceptance letter
- Contact ACO engineer who did the original acceptance, if needed
- Ensure that the applicant follows the guidelines of this notice
- Perform reviews of project plans and data
- Ensure consistency between RSC plans/data and applicant's plans/data
- Inform original ACO of subsequent use/approval of RSC



Section 9 – Common Issues & Considerations

- High-level requirements objectives
- Re-verification issues
- Interface documents
- Partitioning/Protection Considerations
- Safety issues
- Coupling & Cohesion



Section 10 – Changes to RSCs

- When RSC is changed, cannot be reused without another reuse application.
- Changes to RSC may or may not affect all users.



What's Next?

- Hopefully, the document will go to Federal Register soon
- Several projects are using the concept.
- Collecting lessons learned. E.g.,
 - Dealing with deactivated code
 - Concurrent programs using a component
 - Derivative versions of the RSC
 - Additional items for RTOSes (e.g., board-support packages, APIs, ...)
- Please send any questions, comments, etc. to Leanna.Rierson@faa.gov



Summary

- We are making progress in addressing software reuse
- 8110.97 is completed and is being rolled into the Mega Order
- 8110.RSC should be going out for public comment soon
- Late breaking news: 8110.RSC is now AC 20-RSC (I.e., it will be an Advisory Circular rather than a Notice)